THE OPEN UNIVERSITY OF SRI LANKA

FACULTY OF ENGINEERING TECHNOLOGY

BACHELOR OF TECHNOLOGY – LEVEL 4

FINAL EXAMINATION – 2009/2010

MEX4230 – PRODUCTION TECHNOLOGY

DATE : *MARCH 02, 2010*

TIME : *0930 HRS. – 1230 HRS.*

DURATION : *THREE HOURS*

ANSWER ANY FIVE (05) QUESTIONS. *ALL QUESTIONS CARRY EQUAL MARKS.*

Q.01. a. Define and distinguish between **Accuracy** and **Precision.**

b. List the sources of measurement errors.
What is the error in measurement which results from using a steel ruler gauged at $0^{o}C$ at an ambient temperature of $30^{o}C$? How do you compensate this error?

c. Illustrate how a sine bar is used to measure an angle of a small component.

d. Describe briefly Line standards and End standards used in length measurements.

e. Explain clearly how you use a dial gauge to measure the internal diameter of a cylinder bore.

Q.02. a. Explain clearly the terms **Roughness**, **Waviness** and **Lay** in the context of surface texture.

b.

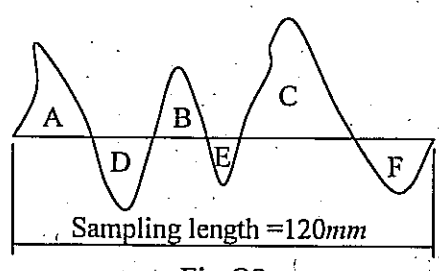


Fig.Q2

Given in Table.Q2 are the areas measured of a surface (shown in Fig.Q2) for determination of surface finish.

Area identity	A	B	C	D	E	F
Area (mm^2)	180	105	240	160	110	170

Table.Q2

If the magnification factor is 5000, calculate the CLA (Ra) roughness value of the surface.

c. Quoting appropriate examples explain the importance of the concept of Interchangeability in mass production.

d. In a limit system the following limits are specified to give a clearance fit between a hole and a shaft each having a $30mm$ nominal diameter.

Hole $30mm^{+0.020}_{+0.000}$

Shaft $30mm^{-0.005}_{-0.018}$

Determine,

i. Hole and shaft tolerances.
ii. Hole and shaft limits.
iii. Minimum and maximum clearance.

Q.03. a. The new ISO recommendation for the nomenclature of cutting tools establishes systems of planes that can be used to define the various angles of the faces and flanks of the tool. In such an arrangement two systems of angles and planes are required. What are these two types of systems and explain them briefly.

b. In an orthogonal cutting test conducted using a dynamometer, the following observations have been recorded,

Rake angle : 15^o
Depth of cut : $2.5mm$
Cutting speed : $30m/min$
Feed rate : $0.125\ mm/rev$
Tangential load on tool : $3440N$
Normal load on tool : $1560N$

Determine:

i. Efficiency of the machine tool if the input to the driving motor was $3kW$ and runs with an efficiency 85%.
ii. Specific cutting energy.
iii. Power dissipated as friction if the chip thickness was found to be $2.5mm$.

Q.04. a. State functions of cutting fluids.
List five types of oil based cutting fluids and describe the specific uses of any two of them.

b. What are the undesirable effects due to the application of cutting fluids?

c. Explain what the built-up-edge is in the context of chip formation in metal cutting.
Explain what can you consider as a favorable factor in the formation of built-up-edge during the cutting process.

d. Clearly explain the Taylor's tool life relationship.
When reducing the diameter of a bar stock from 55*mm* to 50*mm* at a speed of 110*rpm* with a H.S.S. cutting (n=0.2) tool, its life was found to be 2*hrs*. What would be the speed if the tool life is to be 3*hrs* and 30*mins*.

Q.05. a. List five main considerations that should be looked into when designing a machine tool. Select a suitable example and describe how those five design requirements can be useful for the operation of the machine.

b. Explain the types of machine tools based on the degree of accuracy.

c. List important requirements of machine tool structures.

Reinforced concrete beds are an ideal substitution for metal beds. However in practice, the use of concrete beds for machine tool is limited. Give reasons for the above statements.

Q.06. a. What are the different drives used for providing cutting speeds in machine tools? Why it is necessary to provide variable spindle speeds in machine tools?

b. Assume that a lathe should accommodate work in a range of diameters from 20*mm* to 400 *mm* for an average cutting speed of 20 *m/min*. Determine the minimum and maximum spindle speeds required to accommodate the range of diameters.
Also determine spindle speeds, if the above lathe has 8 speeds arranged in a geometrical progression.

c. You have been asked to design a gear box for the specifications stated below.

Number of speeds (n),
Common ratio (ϕ),
Minimum speed (n_{min}) and
Motor speed (n_o).

Clearly explain the steps you would follow when designing the gear box. Your explanation should state the methodology used at each step.

Q.07. a. Explain the causes of wrinkling of cups during deep drawing operations. What are the precautions that can be taken to minimize this undesirable effect?

b. What is the spring back effect in bending? State under which circumstances this effect tends to increase, and discuss the ways that spring back effect may be neutralized.

c. A cup is drawn by using a blank of diameter $100mm$ having a thickness of $2mm$. Yield strength of the blank material is $200MPa$.

(i) Determine the dimension of the cup.
(ii) Calculate the required drawing force.

Clearly state any assumptions made.

Note: - Drawing force (P_d) is expressed by,

$$P_d = D_p \,.\, h.\, T_s \left(\frac{d_o}{D_p - 0.7} \right)$$ in usual notations.

Q.08. Write short notes on any <u>five</u> of the following topics.

(i) Classification of machine tools according to the degrees of specialization. Give examples for each category.
(ii) **Abbe principle** as applicable to length measuring instruments.
(iii) The necessity of machine tool alignment, and state the basic alignment tests.
(iv) Classification of gears according to the toothing system. Illustrate each category.
(v) Plastic deformation and thermal cracking of tools.
(vi) Selection parameters of measuring instruments. Explain the importance of two of the parameters quoting appropriate examples.
(vii) Taylor's principle as applicable to gauging.

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